Deliverability Assessment Methodology

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- Please keep comments professional and respectful.
- Please try and be brief and refrain from repeating what has already been said so that we can manage the time efficiently.

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Agenda

- Introduction and summary of key issues
- On Peak Deliverability Methodology review
- Review of On Peak Deliverability Methodology Stakeholder Issues and Concerns
- Off Peak Deliverability Methodology
- Review of key issues for next steps

CAISO Policy Initiative Stakeholder Process

We are here

What is the purpose of the ISO's deliverability methodology?

- To test that the transmission system can reasonably ensure that resource adequacy capacity can be delivered to load during stressed system conditions.
- These resources first have to meet basic interconnection requirements so that they can be reliably interconnected, and could choose to operate energy-only without providing resource adequacy capacity.

ISO Deliverability Requirements:

- Developed in 2005, accepted by FERC and CPUC, and began use in 2006, with considerable guidance from PJM's model and recognizing MISO uses a similar approach
- A comprehensive review was conducted in 2019 and 2020 in response to the changing resource fleet and peak shift
  - Led the current "high system need" and "secondary system need" approach
- Other adjustments have been made since:
  - Aligned with a relaxation of a WECC standard, adjusted the dispatch levels for storage.
- Requests for another review was initiated through the ISO policy catalog raising a number of new concerns not expressed in the earlier review
- The ISO produced an update paper in December 2022, indicating a target of March 31 for an issue paper – subsequently released on May 31.

How are the transmission needs identified and managed?

- The transmission planning process approves larger “area” deliverability upgrades for preferred zones, and that capacity is then allocated among the resources that move forward.
- The generation interconnection process identifies:
  - Smaller “local” deliverability upgrades that depend on the specific resources inside the zone
  - Reliability requirements needed to allow the resource to physically connect and be energized (that alone would provide no assurance that the resources can be relied upon in stressed conditions.)
  - Interconnection requirements.

	Summary of Stakeholder Concerns and Requests	Consideration
1	Study of High System Need and Secondary System Need – is the "secondary system need" study necessary?	Needs further discussion. ISO transition from one to two scenarios was a step in adapting to a more complex resource fleet, predating the CPUC transition towards a 24 hour slice of day approach.
2	The need for study of n-2 contingencies on double circuit towers	We see this as a NERC criteria requirement, rarely binding, and with sub-optimal and untimely results if left to the transmission plan to address.
	ISO alternative – explore policy change to provide interim deliverability while waiting for the n-2 related deliverability upgrades (usually RAS or reconductoring) to be completed	Opportunity to explore a risk-based approach - still requires reliability upgrades to be in place but balances risk of disrupting resources coming online with higher (interim) operational complexity.
3	Overarching concern with PTO timelines being extended for deliverability upgrades, disrupting resource PPAs and in-service dates	Opportunity to explore providing interim deliverability if deliverability upgrades are delayed by PTO, taking a risk based approach and respecting reliability needs
4	Concerns with inclusion of Diablo Canyon in studies after 2025 (We do not rely on Diablo Canyon for resource planning or addressing grid needs after 2025)	Needs further discussion. Note that Diablo Canyon is expected to provide RA capacity post 2025, and PG&E does retain "repowering" rights for up to three years after retirement.
5	Suggestion that local capacity resources should be assessed only on their ability to serve local load , and shouldn't be required to also provide system capacity – essentially splitting system and local capacity into two separate products.	Requires a larger policy discussion in the ISO RA initiative. Technical considerations will be a factor considering among other issues the coincidence between local and system needs.
6	Soften current requirement that resource adequacy resources in a gen pocket can be dispatched simultaneously at times of system need (and address misunderstanding that our methodology currently can drive capacity <u>out</u> of one area and <u>into</u> another.	Need to clarify purpose of methodology and current methodology. We study one generation pocket at a time, and at reasonable dispatch levels, to ensure reasonable chance of serving load in stressed conditions
7	Dispatch levels – use of exceedance-based output levels instead of Qualifying Capacity-derived levels.	Need to clarify basis of qualifying capacity levels based on a resource's contribution over a year and relevance to testing its contribution at stressed system conditions

THE ON-PEAK DELIVERABILITY ASSESSMENT METHODOLOGY

Overview of the Deliverability Analysis Base Case

- Internal generation is dispatched in the base case to evenly distribute the total available generation.
- Imports are modeled based on the Maximum Import Capability (MIC) levels.
- Since all available capacity is needed, it is all dispatched close to its maximum available capacity without consideration of cost.
- Base case values also represent approximate dispatch of generation outside of the study groups during the analysis.
- Summer peak load level

Overview of the Deliverability Analysis Testing Process

- An automated tool is used to identify and analyze study groups.
- Generation output inside of a study group is increased during the study.
- The process is intended to test the ability of resources inside of the study group to be dispatched at full output when various resources outside of the study group are unavailable.

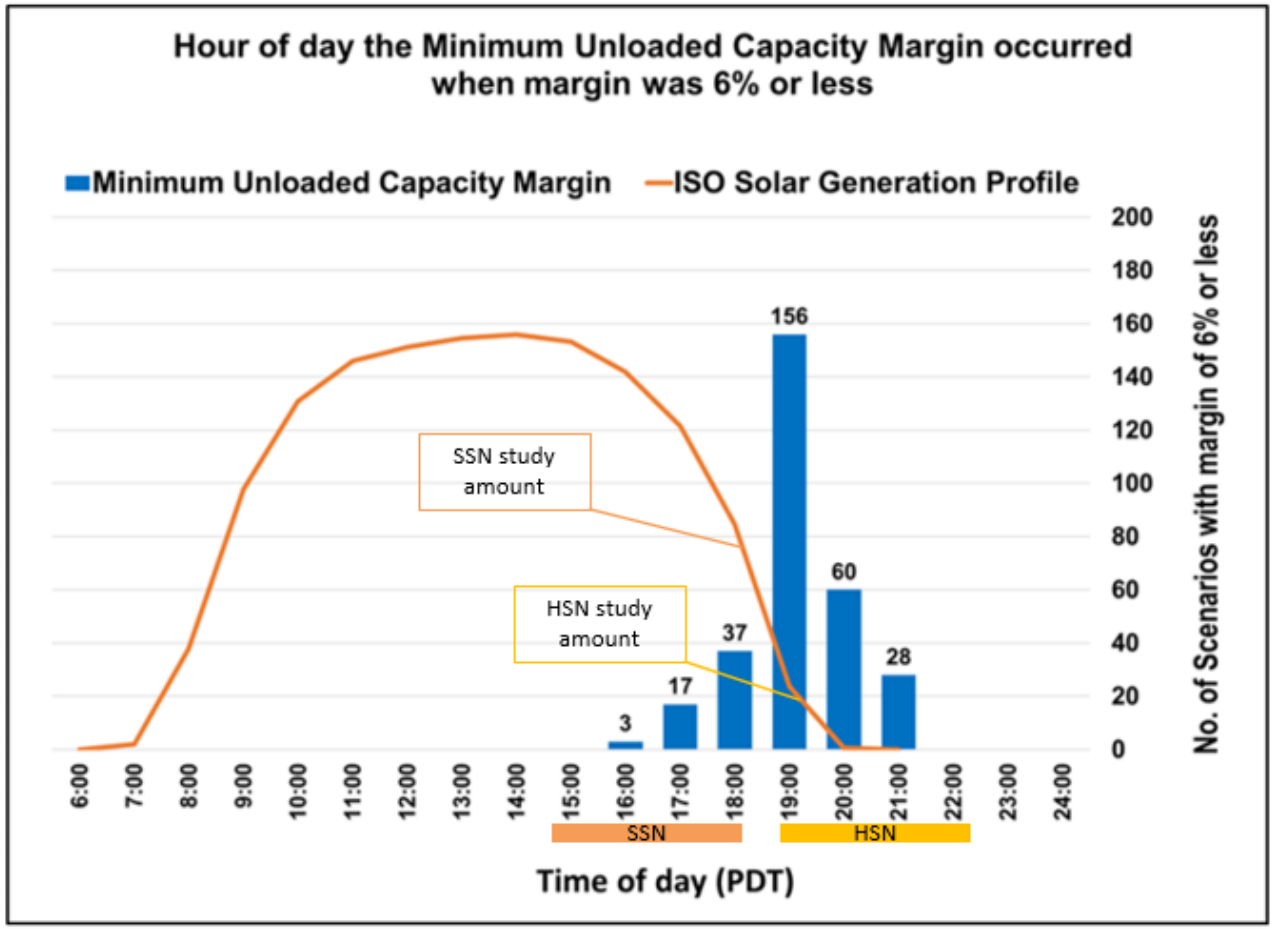
Generation Capacity Study Assumptions

- Conventional generation is studied up to their NQC values
- Intermittent generation dispatch values are determined by stochastic analysis of their production during resource shortage conditions
  - This is to be updated to 24 different “slice-of-day” values
- The underlying objective is to count the equivalent value of the resources during resource shortage conditions.
- The ISO deliverability methodology currently studies two different equivalent values for intermittent resources: the HSN value and the SSN value

HSN and SSN Study Scenarios

- The highest system need (HSN) scenario represents when a capacity shortage is most likely to occur.
  - 20% exceedance value of wind and solar for Hours 19 through 22, during resource shortage conditions
  - Very low solar output
- The secondary system need (SSN) scenario represents hours when solar is dropping off and dispatchable resources are ramping up, but a capacity shortage could occur.
  - 50% exceedance value of wind and solar for Hours 15 through 18, during resource shortage conditions
  - Low solar output

Illustration of the HSN and SSN Scenarios



- Dispatchable resources that materially affect a transmission constraint are dispatched at their expected maximum available capacity.
- Renewable resources are studied at their expected output levels in those time periods (using a percent exceedance method)

Maximum resource output tested in the deliverability assessment

Resource	HSN			SSN		
	SDG&E	SCE	PG&E	SDG&E	SCE	PG&E
Solar	3.0%	10.6%	10.0%	40.2%	42.7%	55.6%
Wind	33.7%	55.7%	66.5%	11.2%	20.8%	16.3%
NM Wind	67%			35%		
Wy Wind	67%			35%		
Diablo OSW	100%			37%		
MB OSW	100%			49%		
HB OSW	100%			53%		
Energy Storage	100% or 4-hour equivalent if duration is < 4-hour			50% or 4-hour equivalent if duration is < 4-hour		
Non-Intermittent resources	NQC or 100%					

ON-PEAK DELIVERABILITY METHODOLOGY ISSUES SUMMARY

Comparison of CAISO, PJM and MISO deliverability studies

- Stakeholder concerns and questions:
  - Are CAISO's practices more conservative than other entities such as PJM and MISO?
  - Does CAISO's methodology identify more transmission upgrades as needed than the methodology used by PJM and MISO?

- CAISO's response:
  - After researching these claims, and summarizing the deliverability methodologies in Table 2, the CAISO has concluded that MISO's and PJM's practices are reasonably comparable to the CAISO's.

Comparison of Study Parameters

	PJM	MISO	CAISO
Reliability Study			
Contingencies	See Deliverability Study below	All TPL-001-5 (N-1 and N-2)	All TPL-001-5 (N-1 and N-2)
Dispatch wind and solar	See Deliverability Study below (a light load analysis is also required)	100%	100%
Mitigation for thermal overloads	Transmission upgrades	Transmission upgrades	Congestion management
Deliverability Study			
Contingencies	N-1 and common mode (N-2)	N-1 but have to mitigate for N-2 in the reliability study (see above)	N-1, P7(N-2) (do not have to build transmission upgrades for N-2 in the reliability study)
Load	Summer peak	Summer peak	Summer peak
Wind and solar output	Wind at 13% to 20%	Wind: Historical output during top 8 peak load hours over 3 years Solar: historical average output for hours 15, 16, and 17	20% exceeded level during Hours 19 - 22 in summer months and (loss of load event in ELCC simulation by CPUC or UCM < 6% in CAISO summer assessment)

Requirement for study of N-2 contingencies

- NERC Reliability Standard FAC 002, is an applicable reliability standard for generation interconnection studies.
  - It requires studies to evaluate system performance under in accordance with Reliability Standard TPL-001.
  - NERC Reliability Standard TPL 001 requires common mode n-2 contingency analysis.

Stakeholder Comments on N-2 Contingencies

- CalWEA suggested that MISO and PJM did not consider n-2 contingencies in their analyses as part of the requirement for obtaining deliverability.
  - This is not the case; the consideration of n-2 contingencies by both MISO and PJM is discussed above.
- AES Clean Energy believes that the deliverability methodology should only consider n-2 contingencies the way they are considered in real-time operations (when risk levels are not elevated).
  - If these contingencies are not mitigated in the planning horizon, e.g. planned for, then they become unmanageable in the operating horizon

The ISO does see possible mitigation options to the n-2 concern

- RAS guidelines can be potentially relaxed while waiting for an upgrade to be constructed
- If a transmission project is delayed then the n-2 requirement could be relaxed during the operating horizon, provided that reliability can be maintained
- Alternatively some form of Interim Deliverability Service (IDS) could be provided as long as planned mitigation is under development, and operational concerns are addressed

Simultaneous dispatch of generation

- The process is intended to test the ability of resources inside of the study group to be dispatched at full output when various resources outside of the study group are unavailable.
- BAMx stated that the generation dispatch should realistically represent their expected levels of operation and should not necessarily assume simultaneous operation at their "qualifying capacity" level, as assumed in the ISO's deliverability assessment methodology.
  - During a resource shortage condition, all available resources will be needed simultaneously to serve all of the firm load
  - Each of the last three years have seen such conditions

Network upgrades exceeding actual local load needs

- Transmission constraints are classified as Area Deliverability Constraints (ADC) and Local Deliverability Constraints.
  - avoids the identification of excessive delivery network upgrades
  - upgrades are not required for ADCs
- AES Clean Energy stated that the studied deliverability capacity often exceeds the local load within the study area, and often results in inaccurate network upgrades requirements.
  - This concern is addressed by the Area and Local deliverability constraint framework
  - Constraints with large amounts of generation behind them that trigger large, high-cost network upgrades are classified as ADCs
  - Upgrades are not required for ADCs

Excessive transmission upgrades

- Generation interconnection and transmission planning processes are coordinated
- Also coordinated with the CPUC's IRP process
- Higher-cost delivery network upgrades that would be triggered by many generation interconnection request projects are developed through the transmission planning process
- BAMx stated that expensive transmission upgrades have been deemed necessary by the ISO to make projects deliverable, and that the ISO should not sanction a transmission planning and generation interconnection and deliverability allocation process (GIDAP) whose underlying theme seems to be "deliverability at any cost."
  - Between 2012 and 2021 very few policy-driven transmission upgrades were identified as needed for the purpose of deliverability

Secondary System Need study

- The deliverability assessment is performed under two distinct system conditions – the highest system need scenario (HSN) and the secondary system need scenario (SSN).
- With the growing complexity of the resource fleet, the CPUC has been driven to move from a single assessment hour to a 24 “slice of day” approach for RA purposes.
- The SSN study focuses on the transition period when the gross load is still high and the solar production is dropping off.
  - a resource shortage is less likely but could still occur
- BAMx indicated that if the expected storage discharging behavior is properly modeled, then the SSN assessment should not identify more upgrades than the HSN assessment.
  - the storage modeling assumptions in the SSN assessment are based on the recent historical storage discharging information provided by the ISO during the 2022 SSN study assumption update stakeholder process.
  - This depends on the specifics of the resources’ locations

Transmission Planning Process versus Generation Interconnection Process

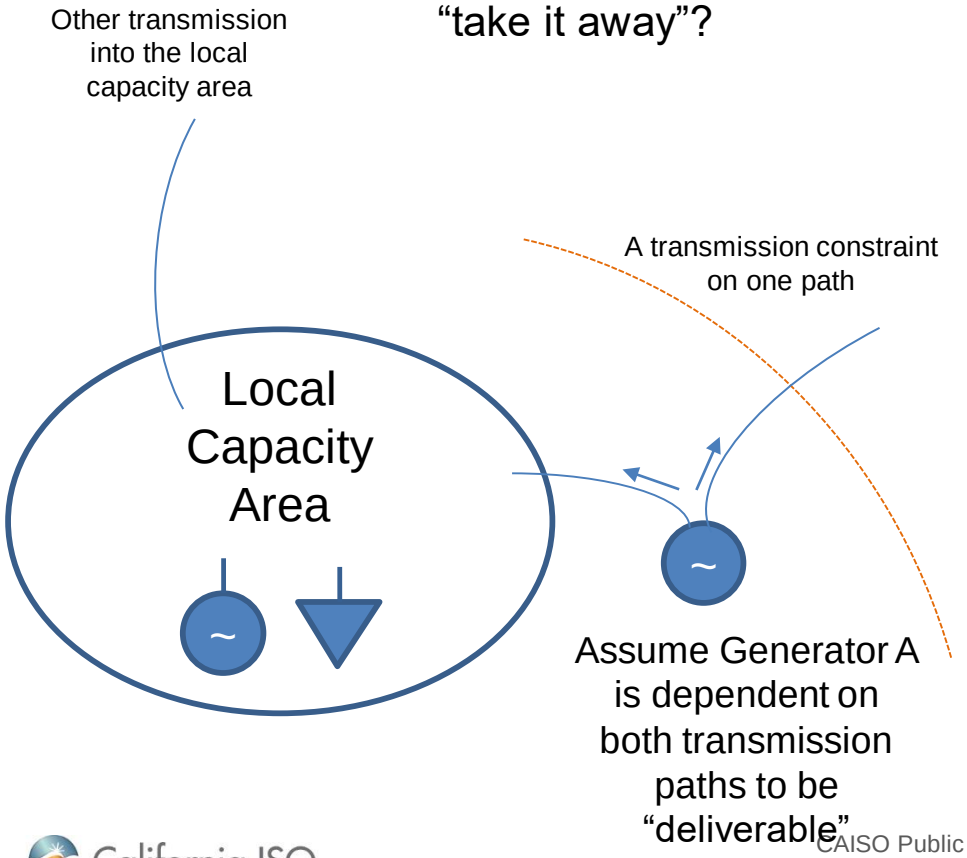
- The generation interconnection and transmission planning processes are coordinated as described above.
- The decision to build most transmission delivery network upgrades is not made in the GIDAP, and deliverability is allocated only up to the capability of the transmission system currently planned.
- The California Energy Storage Alliance (CESA) asked whether n-2 contingencies should be mitigated in the transmission planning process instead of in the generator interconnection process.
- BAMx provided a similar comment, suggesting that a Transmission Economic Analysis Methodology be used to determine when n-2 contingencies need an upgrade.
  - This would lead to potentially higher ratepayer costs
  - In the planning and procurement of new resources, the full set of transmission upgrade costs need to be considered to minimize the costs to ratepayers.

Deliverability for Local Capacity Resources

- As described above, the goal of the On-Peak Generator Deliverability Study Methodology is to determine if the aggregate of available generation output in a given area can be simultaneously transferred to the remainder of the ISO Balancing Authority Area during resource shortage conditions.
- The same deliverability test is applied to generation in local capacity areas as is applied to generation outside of local capacity area.
  - A generation pocket may include a group of resources inside a local capacity area and immediately outside of the local capacity area that can all be constrained if more generation is added and results in overloading the transmission system exporting the excess generation from the area.
- CalWEA's comments appear to suggest that the ISO deliverability methodology requires the deliverability of LA Basin storage all the way into the SF Bay Area.
  - This is not accurate. If necessary, generation only needs to be able to be exported out of the local generation surplus areas shown in the posted transmission constraint maps scaling back system resources (not other local resources)
- LSA suggested that the ISO consider whether some portion of the LCR requirement could be satisfied by resources passing a test to be deliverable only to their LCAs.
  - This will be explored in the ISO's Resource Adequacy initiative.

Representative example of why new resources in local capacity areas are not always deliverable

- If deliverability is preserved for existing generation in the local capacity area and a new generator is also added inside the local capacity area, Generator A's deliverability may be reduced – do we "take it away"?



- Only generators that materially contribute to the flow on the constraint are dispatched to their tested value – others are scaled back

Net Qualifying Capacity versus Exceedance Based Study Amounts

- The generation dispatch assumptions in the deliverability study were described above.
- CalWEA stated that the ISO's current practice of using values that exceed current QCs for VERs requesting deliverability is inappropriate because the system is designed to rely only on the NQCs of VERs, not more, to meet the peak scenario demand during the operating conditions that ISO studies.
- The solar study amount levels in the HSN study are already at 10% of nameplate capacity, which are lower than the NQC values during the summer months.
- The SSN solar study amounts are reasonable for the time period they represent, and with the recent modification to that study it is almost always less binding than the HSN study.

Wind Generation Study Levels

- Though the HSN wind study amounts are higher than the NQC, wind production levels are variable.
  - On a particular day the wind generation in area A may be producing higher than NQC levels while wind generation in area B is producing nothing.
  - The NQC value is generally based on the aggregate production of areas A and B.
  - If the wind generation in area A had to be curtailed to its NQC value because of transmission constraints, then the actual aggregate production of the wind generation in areas A and B would be less than their combined NQC values because of the transmission constraint.

OFF-PEAK DELIVERABILITY ASSESSMENT METHODOLOGY

Off-Peak Deliverability Assessment Methodology

- The objective of the off-peak deliverability assessment is to identify local transmission upgrades needed to relieve excessive renewable curtailment caused by transmission constraints.
- ISO system load is between 55% to 60% of summer peak load.
- Conventional generation is at minimum output levels
- Wind and solar generation is assumed to be running at its expected output
  - Identify transmission bottlenecks that would cause excessive renewable curtailment, but the study assumptions focus on system conditions when a system-wide oversupply of resources is not likely.

Off-Peak Deliverability Assessment Upgrades

- Identifies transmission upgrades for local constraints that tend to be less expensive. The need for such upgrades are highly dependent on the development of specific generation projects interconnecting in a small localized area.
- Relies on the TPP framework to approve transmission upgrades for area constraints that tend to be expensive. For area constraints, the general placement of new renewable generation in the portfolio is sufficient to identify the need for any upgrades.
- The curtailment risk is regardless of the generator's deliverability status, so this study considers both full capacity and energy only generators.

REVIEW OF KEY ISSUES

1. Study of High and Secondary System Need – is than one stressed system condition necessary?

- The primary test is the “high system need” at the time of net peak (which is now also the time of our gross peak)
- The secondary test is currently run testing the critical period when solar is dropping off, but has not bottomed out:
  - This tests the ability for other resources to play their expected role as the solar resource output falls away – managing the transition.
- The CPUC slice of day approach emphasizes the role different resources are expected to play at 24 different times of the day, which suggests more, not fewer tests.
- This issue requires more discussion with stakeholders.

2. The need to consider n-2 (on common tower) contingencies

- The ISO must plan for mitigating impacts, notwithstanding whether they are only enforced in real time when risk is elevated or not.
- Leaving mitigation to the transmission planning process is neither timely nor as effective if not addressed by the generator
- The ISO appreciates the concern with schedule delays in achieving deliverability status, and would like to explore a policy change:
  - Consider awarding interim deliverability on a case by case basis while waiting for the n-2 mitigation to be implemented
    - Balance increased operational complexity and some modest interim increase in system risk against disruption risk for new resources coming online.
    - This would be applied in cases where there aren't reliability concerns

3. Overarching concern with delays of deliverability network upgrades

- These projects appear to be at higher risk of deferral when utilities are facing staffing or capital constraints. In the near term, they do not threaten reliable operation of the transmission system.
- The delays can threaten the resources' PPAs, and create a scramble for the load serving entity to procure a different alternative resource
- The ISO would like to explore providing interim deliverability based on the original schedules, and accepting in the interim period a higher risk of deliverability constraints, rather that disrupt the resource procurement cycle

4. Request to remove Diablo Canyon from deliverability studies post-2025

- The ISO appreciates the offshore wind industry's concerns
  - ISO has clarified that the existing 500 kV network can support 3000 MW of offshore wind with Diablo in place, 5000 MW after retirement – ISO coordinating with state agencies and BOEM.
  - Timing and certainty of access to the larger amount is a growing concern
- The current approach is to ***not*** rely on Diablo Canyon after 2025 in resource planning or supporting the transmission system, but reliable operation needs to be maintained and mandatory study standards adhered to.
- Also, Diablo Canyon is expected to provide RA capacity up to its retirement
- Even after retirement, PG&E holds LGIA-based rights for repurposing for up to three years. The LGIA stays in place until retirement; it is unclear how deliverability would be removed.
- This is an evolving issue that will need more industry discussion

5. Consideration of separating local capacity resources from system capacity resources

- Creating two separate and distinct products (versus local capacity currently being a “premium” service that also meets system needs) requires new approaches to manage the two sets of procurement requirements.
- These issues reach beyond the deliverability study methodology.
- The ISO suggests this issue should be considered in the ISO’s upcoming resource adequacy initiative.
  - Technical considerations will also have to be taken into account, including how coincidence between system and local needs are addressed

6. Simultaneous dispatch of resources inside a generation pocket

- The ISO appreciates the concern that the current sequencing of achieving a path to deliverability to compete in load serving entities' procurement processes is challenging with the overheated queue and application volumes, and pace of new resource development
- Simply softening the standards to provide reasonable access to resource adequacy resources should not be seen as the solution
- Need to clarify purpose of the resource adequacy framework, the purpose of the methodology, and the current methodology
- The ISO is exploring more transformative changes in the IPE process to better align resource planning, transmission planning, generation interconnection and resource procurement

7. Dispatch levels for generation being studied in generation pockets

- Qualifying capacity levels are based stochastically on a resource's contribution over a year, and are not reflective of the output of intermittent resources at times of system stress
- The ISO sees needing to retain the current exceedance level approach for intermittent resources, and will continue to assess the specific levels as needed.

Draft Schedule

May 31, 2023	Issue paper posting
Jun 08, 2023	Meeting
Jun 22, 2023	Comments due
Jul 26, 2023	Straw proposal posting
Aug 02, 2023	Meeting
Aug 16, 2023	Comments due
Sep 25, 2023	Draft final proposal posting
Oct 02, 2023	Meeting
Oct 16, 2023	Comments due
Winter 2023	Board of governors meeting

The schedule is coordinated with the IPE Phase 2 process due to overlapping comments from stakeholders in the two processes

Additional information

- Written comments are due by end of day **June 22, 2023**. Please submit your comments using the comment template available on the initiative webpage: https://stakeholdercenter.caiso.com/StakeholderInitiatives/Generator-deliverability-methodology-review

- Visit initiative webpage for more information: https://stakeholdercenter.caiso.com/StakeholderInitiatives/transmission-planning-process-phase-3-revise-competitive-solicitation-project-proposal-fee

- If you have any questions, please contact isostakeholderaffairs@caiso.com